EPA's Guidance on Nutrient Criteria Development

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Presentation

- EPA's guidance on criteria development
- Expectations for rulemaking packages
- EPA guidance on nutrient criteria development

Criteria Development

- EPA develops water quality criteria under the authority of the Clean Water Act §304(a).
- EPA develops criteria based on:
  - the best available science
  - extensive scientific literature review
  - established procedures for risk assessment and management
  - EPA policy
  - external scientific peer review
  - public input on potentially useful scientific information.
- EPA's recommended criteria are not rules, nor do they automatically become part of the State or Tribe's water quality standards.

Criteria Development

- Generally, States adopt a combination of numeric and narrative criteria

- State adopted criteria must meet the following requirements (40 CFR 131.11(a)) :
  - Protect the designated uses, using the criterion most protective of the most sensitive use
  - Be based on a sound scientific rationale
  - Include sufficient parameters (e.g., acceptable concentrations) to protect the designated use

- CWA § 303(c) requires EPA to review and approve/disapprove State WQS

Numeric Criteria

- Establish clear and consistent targets for listing, TMDLs, and permits
- Expedite listing, TMDLs, and permits
- Can be based on site-specific, regional or statewide analyses
- Can be implemented in concert with discharger-specific variances

Narrative Criteria

- For narratives to be protective - important to have implementation methods
  - Implementation methods will explain how the state will interpret the narrative criteria -- how a quantifiable measure be identified
- Without detailed implementation methods…
  - a narrative approach may not be effective in protecting designated uses
  - interpretation of narratives essentially transfers/delays the WQS decision to the listing, TMDL and permit processes
- Under FL Impaired Waters Rule (IWR) decision, methods that affect level of protection may still be considered WQS even if in a separate document (e.g., a listing method)

Narrative vs. Numeric Criteria

- EPA encourages states to adopt numeric nutrient criteria because:
  - Narrative criteria still require site-specific application for TMDL and permit purposes
  - Narrative criteria can be difficult and resource intensive to interpret
  - Application of narrative criteria may decrease consistency and transparency
  - Narrative criteria may be less protective of designated uses
  - Numeric criteria are more efficient to adopt and implement

WQS Application

- Numeric and narrative criteria are used to establish Water Quality Based Effluent Limits (WQBELs)
- If the state determines that the WQBEL cannot be achieved, a discharger-specific variance can be adopted.
- Criteria adopted through these variances can be based on consideration of factors such as economics and technology

State WQS Package

- **WQS packages submitted to EPA should include:**
  - Use designations consistent with the CWA
  - Methods and analyses used to support the standards
  - Water quality criteria sufficient to protect designated uses
  - Antidegradation policy and accompanying implementation procedure
  - Information to support uses not specified in CWA Section 101(a)(2)
  - State policies affecting the application and implementation of the standards (e.g., variance policy)
  - Certification by the AG that the standards were duly adopted according to State law

Timelines

- For WQS approvals, **60 days** from the submission date to issue a letter (40 CFR 131.21(a)(1)).
- For WQS disapprovals, **90 days** from the submission date to issue a letter and specify changes to bring the standards into compliance with the CWA (40 CFR 131.21(a)(2)).
- The standards become applicable for CWA purposes after EPA approval (40 CFR 131.21(c)).
- States must review standards at least once every 3 years (40 CFR 131.20).

History of Nutrient Criteria

- Nutrients (Nitrogen and Phosphorus) were consistently one of the top pollutants on the CWA Section 303(D) Lists to Congress Reports beginning in the early 1990s.
- The “Nutrient Criteria Program” was initiated in 1995.
- Public recognition of the problem increased in 1998 and the program was accelerated by….

The “Cell from Hell”

- Stories about Pfiesteria *piscicida* were carried *daily* by the Baltimore Sun during the summer of 1997, and hundreds of other newspapers.

Quick EPA Action

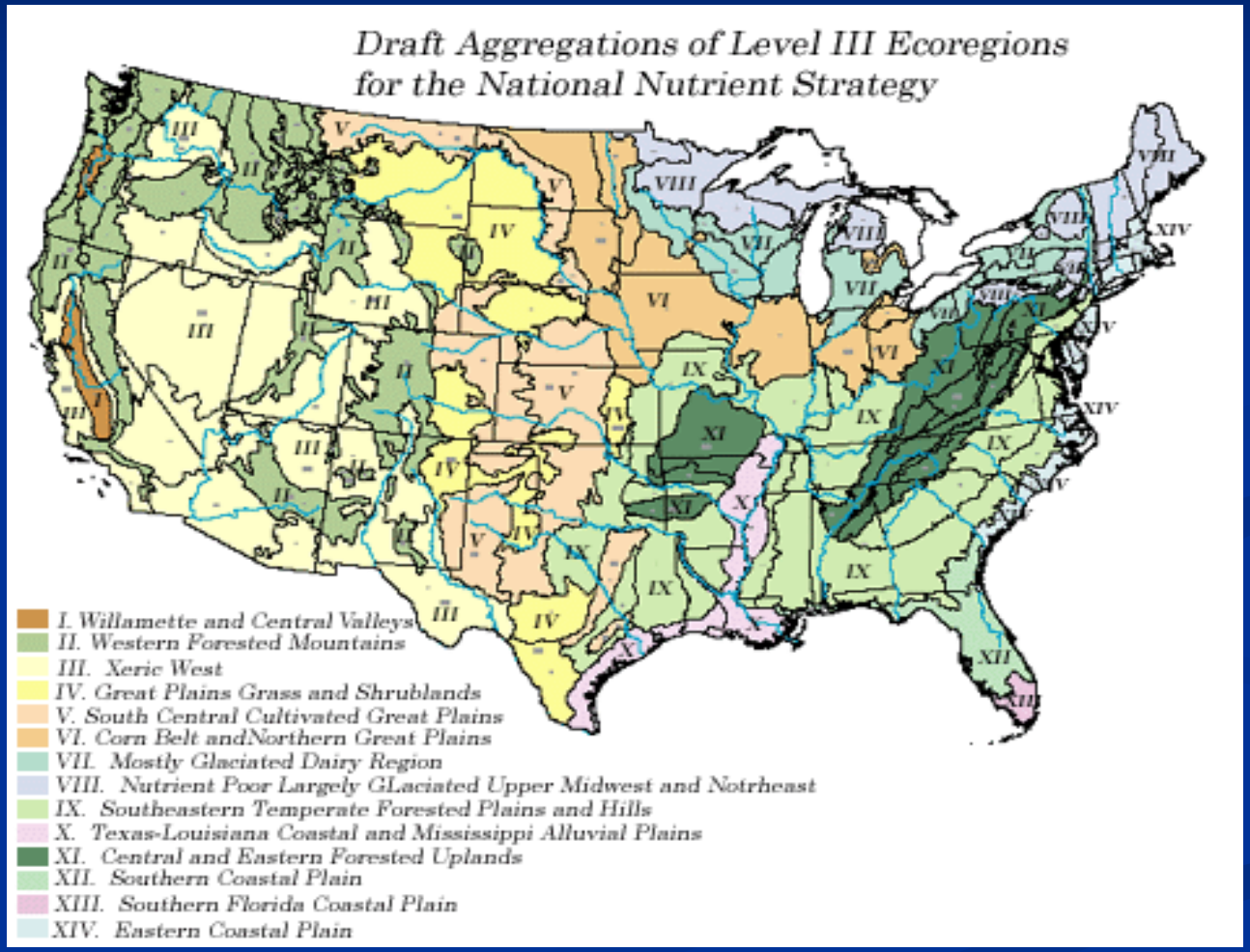
- **Principal Goal: Develop Nutrient Criteria across the nation in 3 years.**

- The criteria needed to address nutrient pollution, not natural enrichment.
  - Primary Parameters:
    - Total P, Total N, Chlorophyll a, some measure of water clarity (e.g., Secchi disk depth, turbidity, TSS), response measure
  - Types:
    - Numeric criteria, or narrative with numeric translator

Initial Approach

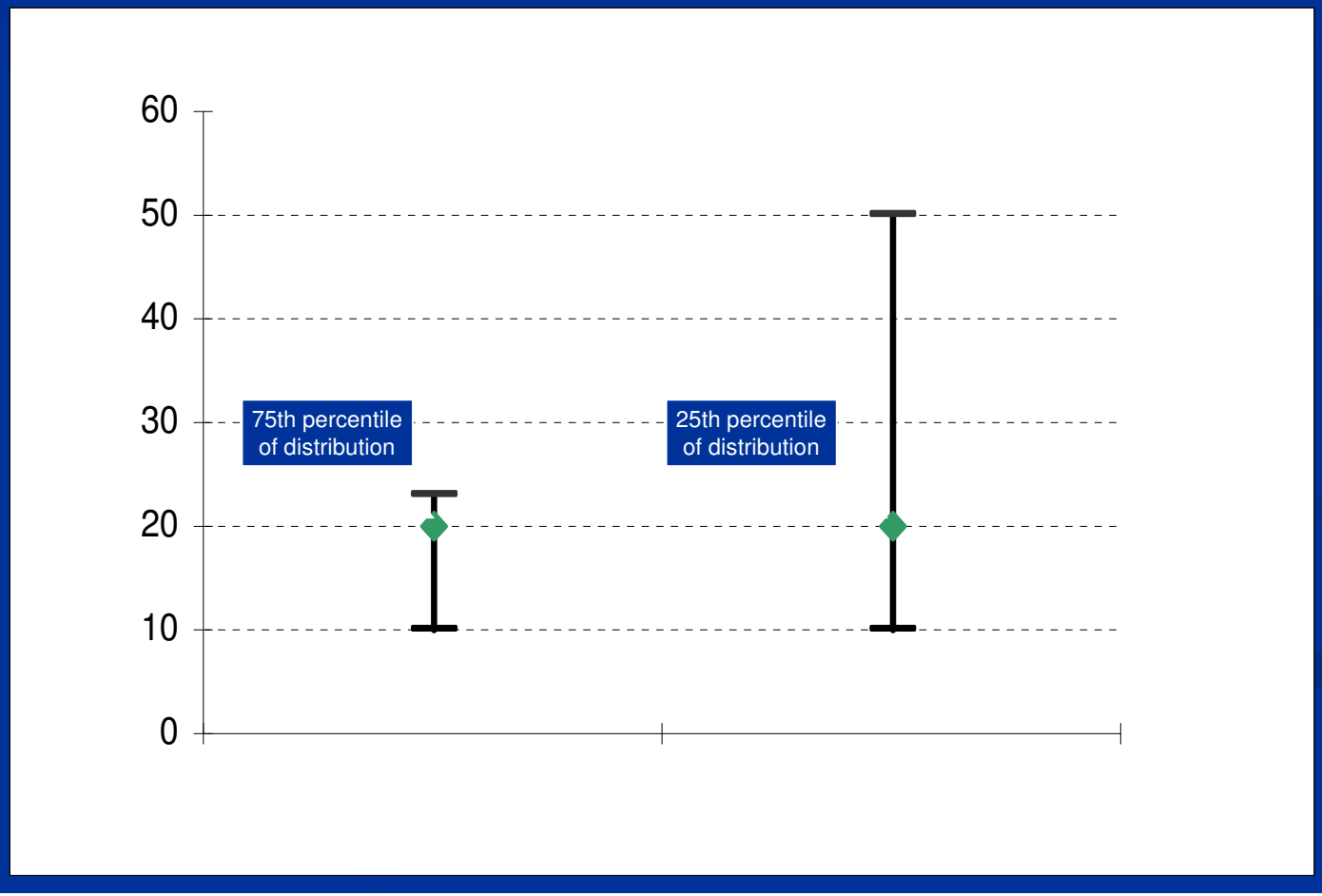
- EPA calculated “estimated reference conditions” using a frequency distribution of ecoregional data.
- These CWA § 304(a) criteria were recommended for use as **starting points** for states to develop their own criteria, using this, or other scientifically defensible methods.

Ecoregional Classification



Distributional Approach

The 25th or 75th percentiles were an estimate of reference conditions – protective of all uses.



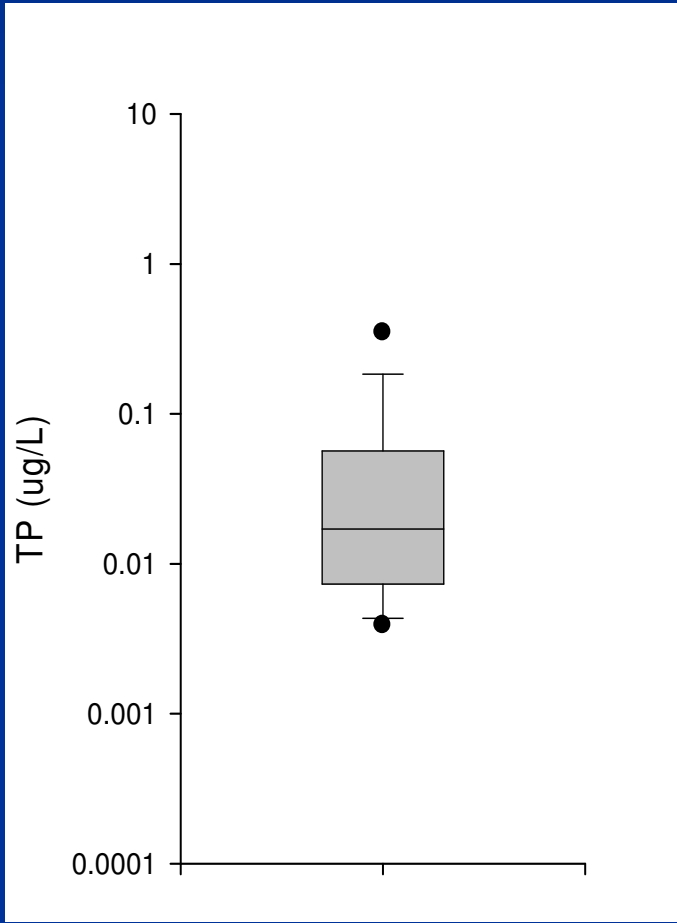
Shift in Policy

- EPA responded to the critique of the percentile approach in 2001 with a policy of “flexibility”, encouraging states to make progress on developing nutrient criteria using different approaches.
- Many states moved towards a “stressor-response” approach and began field studies to identify the algal (diatom and periphyton) or macroinvertebrate response to N and P.
- HQs established a technical support center (N-STEPS) to assist states with the extensive technical challenges involved in these stressor-response approaches.

EPA Recommended Approaches

- Frequency Distribution Approach (Reference Approach)
- Stressor-Response (Effects Based)
- Scientific Literature
- Models

Distributional



- Reference
- All
- Attaining

- Which percentile?

Stressor- Response

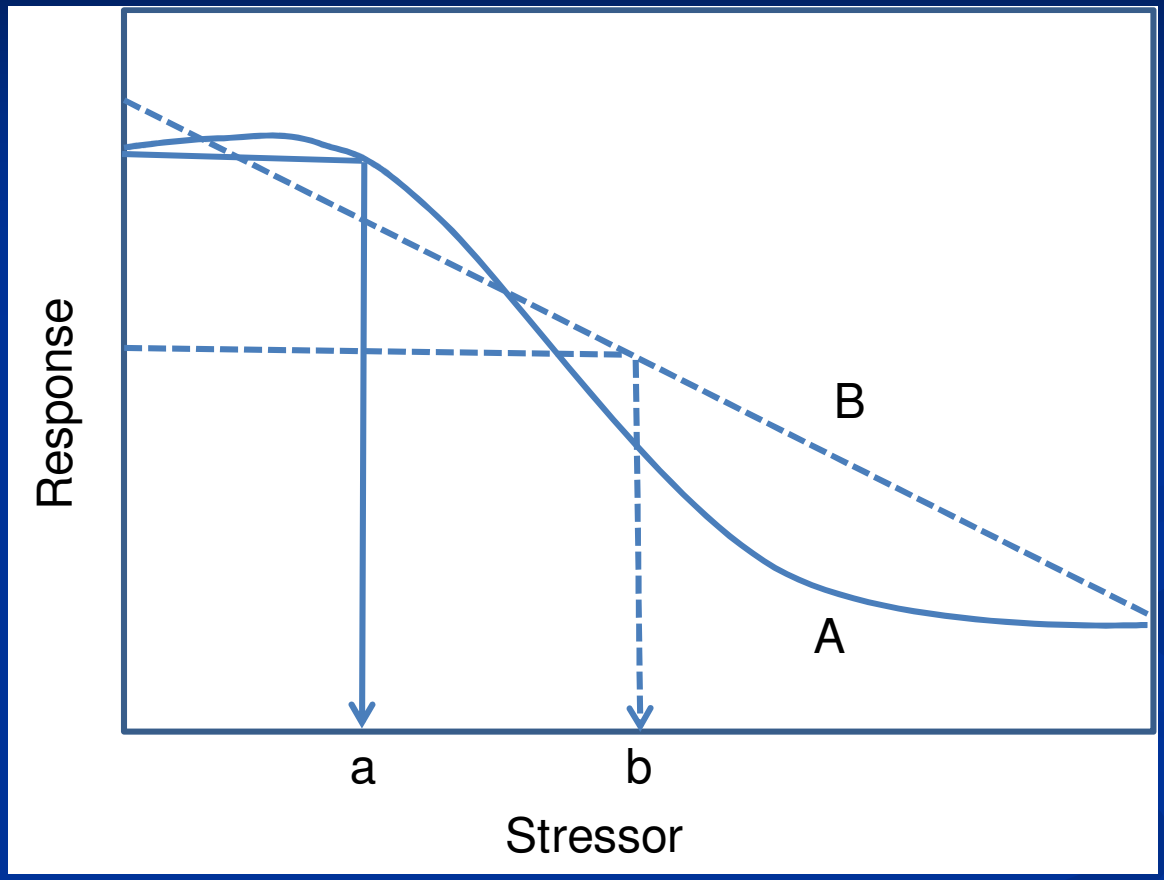


Figure 1 Plot showing two stressor-response relationships, where the response is a direct measure of designated use or can be easily linked to a designated use measure. The relationship A is non-linear and B is linear.

Stressor-Response Approach

- Stressor-response approach can help identify levels of N or P which are more “refined” in terms of protecting designated uses.
- A number of sophisticated statistical techniques are available through N-STEPS to help establish response relationships:
  - regression (linear, logistic, multiple)
  - correlation;
  - visual plotting;
  - conditional probability analysis;
  - change-point analysis

Limitations of Stressor-Response Methods

- Amount and quality of data influences analyses
- Environmental data are often messy
- Need to quantify uncertainty
- Need a good linkage between variable & uses. This approach may work for aquatic life uses, but not other uses.
- Issue of covariance: how to handle multiple stressors (e.g., conductivity, sulfate, temperature)?

Scientific Literature

- Established thresholds
- Known effects levels

Comparing effects of nutrients on algal biomass in streams in two regions with different disturbance regimes and with applications for developing nutrient criteria

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SUGGESTED CLASSIFICATION OF STREAM TROPHIC STATE: DISTRIBUTIONS OF TEMPERATE STREAM TYPES BY CHLOROPHYLL, TOTAL NITROGEN, AND PHOSPHORUS

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DEVELOPING NUTRIENT TARGETS TO CONTROL BENTHIC CHLOROPHYLL LEVELS IN STREAMS: A CASE STUDY OF THE CLARK FORK RIVER

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Models

- Mechanistic
- Empirical

Stream Water Quality Model (QUAL2K)

QUAL2K (or Q2K) is a river and stream water quality model that is intended to represent a modernized version of the QUAL2E (or Q2E) model

- Sediment-water
dissolved oxyge
rather than bei
nutrient fluxes
ticulate organic
and the concen
waters.

Bottom algae.
bottom algae.

Regional interpretation of water-quality monitoring data

Richard A. Smith, Gregory E. Schwarz, and Richard B. Alexander
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Abstract. We describe a method for using spatially referenced regressions of contaminant transport on watershed attributes (SPARROW) in regional water-quality assessment. The method is designed to reduce the problems of data interpretation caused by sparse sampling, network bias, and basin heterogeneity. The regression equation relates measured transport rates in streams to spatially referenced descriptors of pollution sources and land-surface and stream-channel characteristics. Regression models of total phosphorus (TP) and total nitrogen (TN) transport are constructed for a region defined as

What is a weight-of-evidence approach?

- Using multiple lines of analysis to define a specific endpoint
- Alternative to single analysis approaches
- Especially useful where clear endpoints may be elusive

Multiple Lines of Evidence

- Generate candidate endpoints
- Weight qualitatively (BPJ)
- Final is a result of multiple lines

35 µg/L
Distribution

30 µg/L
Literature

55 µg/L

60 µg/L
Stressor-response

45 µg/L
Models

National Status of Nutrient Criteria

- Nationally, 7 states have adopted numeric criteria for one or more parameters for at least one entire waterbody type.
- In January 2009, EPA issued a formal determination that "numeric" nutrient water quality criteria are necessary in Florida.
  - EPA plans to propose numeric criteria for FL lakes and flowing waters within 12 months; estuaries within 24 months.
- Nationally and Regionally, EPA is focusing on nutrient problems and working to accelerate the pace to reduce nutrient impacts using a variety of approaches